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AUTHOR Drotar, Dennis
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ABSTRACT

Children diagnosed with environmentally based failure to thrive early during their first year of life were seen at 12 and 18 months for assessment of psychological development (cognition, language, symbolic play, and behavior during testing). Based on a transactional model of outcome, factors reflecting biological vulnerability (wasting and stunting) and family ecology (income level, family size, and ratio of adults to children) were correlated with outcome measures. Predictions that outcome would reflect biological vulnerability and family ecology were upheld for Bayley Mental Development Index and Symbolic Play scores at 18 months but not at different ages or for other measures. Children who were less malnourished at study intake and who were from families with higher incomes had higher levels of cognitive development. Children who were less malnourished and from families with higher incomes and a higher ratio of adults to children had higher Symbolic Play scores. Findings underscored the utility of a transactional model in predicting psychological outcome for childhood disorders such as failure to thrive. It was suggested that models of research and clinical intervention in failure to thrive should consider the conjoint influences of the child's nutritional status and family ecology, especially the impact of resources and their allocation on psychological outcome. (Author/RH)

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EARLY TREATMENT OUTCOME IN FAILURE TO THRIVE: PREDICTIONS FROM A TRANSACTIONAL MODEL[1]

Dennis Drotar, Ph.D.
Departments of Psychiatry and Pediatrics
Case Western Reserve University
School of Medicine

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Abstract

Children diagnosed with environmentally-based failure to thrive early during their first year of life were seen at 12 and 18 months for assessment of psychological development (cognition, language, symbolic play and behavior during testing). Based on a transactional model of outcome, factors reflecting biologic vulnerability (wasting and stunting) and family ecology (income level, family size, ratio of adults to children) were correlated with outcome measures. Predictions that outcome would reflect biologic vulnerability and family ecology were upheld for Bayley Mental Development Index and Symbolic Play scores at 18 months but not at different ages or for other measures. Children who were less malnourished at study intake and from families with higher income levels had higher cognitive development. Children who were less malnourished at study intake and from families with higher income levels had higher cognitive development. Children who were less malnourished and from families with higher incomes and a higher ratio of adults to children had higher Symbolic Play scores. Findings underscore the utility of a transactional model in predicting psychological outcome for childhood disorders such as failure to thrive. Models of research and clinical intervention in failure to thrive should consider the conjoint influences of the child's nutritional status and family ecology, especially resources and their allocation on psychological outcome.

Early Psychological Outcome in Failure to Thrive:

Predictions from a Transactional Model

Environmentally-based failure to thrive is a common pediatric condition which is associated with psychological vulnerability. Preschool children who present with failure to thrive have a higher incidence of behavioral problems than matched controls (Politt & Eichler, 1976). Significant cognitive and learning deficits have also been noted in preschool and school aged children who were hospitalized for failure to thrive as infants (Hufton & Oates, 1977; Singer, Drotar, Fagan, Devost & Lake, 1983). Some children with a chronic history of failure to thrive (psychosocial dwarfism) also develop severe behavioral disturbances (Money, Wolff & Annecillo, 1972; Patton & Gardner, 1963; Silver & Finkelstein, 1967). Although the association between psychological risk and failure to thrive is relatively well established, the factors which contribute to psychological vulnerability within this population have not been well documented. Failure to thrive is an ideal condition in which to study the development of psychological vulnerability versus resilience in accord with a transactional model (Sameroff, 1975; Sameroff & Chandler, 1975) for the following reasons: (1) poor weight gain which occurs in the absence of physical disease provides an objective physical marker which identifies a population of children at risk for behavioral disorders

early in life (Bithoney & Rathbun, 1983); (2) failure to thrive is associated with family environmental stresses which may effect psychological development (Evans, Reinhart & Succop, 1972; Drotar & Malone, 1982; Leonard, Rhymes & Solnit, 1966) (3) children who present with failure to thrive as infants have physical and psychological outcomes ranging from disturbances which severely compromise psychological adaptation to milder problems which are not as disruptive (Drotar, Malone & Negray, 1979, 1980a; Hufton & Oates, 1977).

Environmentally based failure to thrive is a psychosomatic condition which represents the end point of a chronic process that may effect physical and/or psychological functioning. By the time rate of weight gain is sufficiently compromised to warrant pediatric hospitalization, malnutrition may be significant enough to affect social responsiveness and influence caregivers (Politt, 1969, 1973). Since the nutritional deficits associated with failure to thrive are not often reversed by acute pediatric hospitalization (Woolston, 1983), the child's nutritional status and/or physical condition at hospital admission can be construed as biologic risk factors which may affect psychological outcome. The failure to thrive child's biologic vulnerability interacts with a broad range of environmental conditions including a dysfunctional maternal child relationship and family stressors (Roberts & Maddux, 1983). For example, one important stress may be the discrepancy between economic resources that are available and/or allocated for the

child's care and feeding versus what are necessary for optimal developmental outcomes. Total family income sets an upper limit to resources that can be allocated to the failure to thrive child versus other family members, especially other children. In addition, families with many young children and few adult caretakers may not be able to invest as much time and energy into the development of the failure to thrive child as families with fewer children, especially without access to day care or funds for baby sitters (Belle, 1982).

The purpose of the present study was to assess the efficacy of a transactional model in predicting early outcome. Based on assessment of length and weight, two measures of physical status, wasting and stunting were assessed as biologic risk factors. Children with severe wasting often have reduced muscle mass and may require acute nutritional treatment. In contrast, stunting signifies a reduction in body length which is indicative of chronic undernutrition (Waterlow, 1972; Waterlow & Ruttishauser, 1972). Three measures of family ecology were assessed as risk factors: income level, family size, and the ratio of adults to children. In this conceptual framework, family size reflects the consumers of resources and the ratio of adults to children assesses the available adult caretakers relative to the number of children.

In accord with a transactional model, early psychological outcome in failure to thrive was expected to relate to two factors in combination: (1) the child's physical state (or biologic vulnerability); and (2) family ecology.

Method

Selection Criterion

The following criteria selected children free of major organic deficits in accord with pediatric diagnosis of failure to thrive (Bithony & Rathbun, 1983; Schmitt, 1979): (1) weight at or below the 5th percentile based on norms (Hamill, Drizd, Johnson, Reed, Roche, Moore, 1979); (2) absence of major organic conditions that could directly affect capacity to gain weight and/or cognitive development as indicated by physical and laboratory examination, including complete blood count and urinalysis; (3) demonstration of weight gain in hospital (Schmitt, 1979).

Subjects

The mean age (n=68) at study intake was 4.9. (range 1-9 months for 44 males and 24 females from 65 families, including three sets of twins. Children tended to be latter borns (mean birth order = 2.6) from disadvantaged families in urban neighborhoods. Fifty-four families (82%) received welfare. Other families (n=11) were working class (M=3.7) based on Hollingshead & Redlich (1958). Other family demographics were as follows: mean income, $5,800, family size (M=5), and number of children per family (M=2.5).

Subject Recruitment and Sample Attrition

Out of the remaining 76 families, 11 (15%) are no longer enrolled in the study because they moved out of the area, could no longer be located or refused further participation. Families in the attrition sample did not differ significantly from the study

group in demographic characteristics nor did the children differ in age, physical growth or cognitive development at study intake.

Intervention

Following hospitalization, families were randomly assigned to one of three interventions, each of which involved working with family members in their homes but differed with respect to the frequency of contacts and focus of intervention. In two intervention plans, parents or family members were seen for weekly home visits for an average duration of one year. In a less intensive intervention, family members were seen for an average of 6 visits over a year. Type of intervention was expected to affect long-term outcome rather than initial outcomes (12-18 months) which were obtained while most families were still receiving intervention.

Assessment Procedures

Outcome measures were chosen for reliability of scoring, feasibility of administration and sensitivity to the nurturing and stimulation deficits that characterize failure to thrive, and included physical growth, height, weight, and head circumference, cognitive development as assessed by the Bayley Scale of Mental Development. A number of derived growth measures were also calculated including: Wasting was calculated on the basis of the percentage of the child's weight that is typical for a given height, as calculated on the weight/height scale on the growth chart. Higher scores reflect greater impairments. Stunting refers to the percentage of expected length for age and was calculated by comparing

the child's length with the norm for a given age and dividing the child's height by the average height for that age.

Additional psychological measures included rating scales adapted from the Infant Behavior Record (Bayley, 1969) which assess the child's behavior during testing on a five point scale (a score of 5 was the most adaptive rating) in the following areas: Cooperativeness, Object Orientation, Social Orientation, and Goal Directedness. Language ability was determined in children 18 months and older via a battery used by White, Kohan, Antanucci and Shapiro (1978) in a study of the competence of preschoolers from different socioeconomic backgrounds. Finally, capacity to represent experience in the non-verbal medium of play was assessed by the Symbolic Play Test (Lowe, 1975), a structured procedure in which the child is given sets of play objects according to a standardized format and observed in spontaneous play.

Results

Physical Growth and Development at Intake

The means and standard deviations for physical growth and psychological variables are shown in Table 1.

Insert Table 1

At hospital admission, mean rate of weight gain was more than two standard deviations (less than the 5th percentile) below the norms for age (Hamill et al., 1979) compared to a mean percentile

at birth of 32.7. At intake, the majority of children 59 (87%) show at least a mild degree of wasting (M=1.5, SD=0.8) and 32 (53%) a mild degree of stunting (M=0.7, SD=0.7). On the other hand, intellectual functioning based on the Bayley Mental Development Index (MDI) (M=99.4, SD=16.8) is within normal limits. Behavioral ratings (M=11.2, SD=2.6) indicate lower than optimal functioning based on a maximum score of 20.

Physical and Psychological Outcome

As shown in Table 1, the Bayley Mental Development Index (MDI), scores on the Symbolic Play Test and Language Ability are in accord with that of normative samples.

To assess the effect of treatment modality on early outcome, multivariate analyses of variance (MANOVA) were conducted on physical growth (height, weight, and head circumference), Bayley MDI and Behavioral Ratings at intake, 12 and 18 months. One-way analyses of variance were also conducted on Symbolic Play scores and Language ability at 18 months. In accord with expectations, none of these analyses show main effects of type of treatment. However, the early growth and development of children is above the level of impairments generally found in this population. Median estimates of risk for serious intellectual impairment are 20% and growth impairments 25%.

Predictions of Outcome

Predictions based on a transactional model were tested by separate stepwise multiple regression analysis for each outcome

measure at 12 (Bayley MDI and Behavioral Ratings) and at 18 months (Bayley MDI, Behavioral Ratings, Symbolic Play, Language Ability). In each analysis independent variables included physical status (wasting and stunting) and family ecology (total family income, family size and ratio of adults to children). Significant findings from these regression analyses are shown in Table 2.

Insert Table 2

The Bayley MDI at 12 months of age relates to the ratio of adults to children ($p < .05$). Children from families which had higher ratio of adults to children had higher scores on the Bayley at 12 months. On the other hand, a single physical status variable, wasting accounts for the most variance in Behavioral Ratings at 12 months. Children with less severe wasting at admission (lower scores) demonstrate more adaptive behavior ($p < .05$).

Predictions of 18 month outcome follow a different pattern. Family income and wasting predict Bayley MDI ($p < .01$). Bayley MDI is associated with higher family income and lower wasting. Family income, number of adults to children, and wasting relate to Symbolic Play ($p < .01$). Higher Symbolic Play scores are associated with higher family income, a higher number of adults to children and less severe wasting. Wasting correlates with Behavioral Rating ($p < .05$). Children with less severe wasting show more adaptive behavior ($p < .01$). Finally, higher language scores at 18 months are associated with a higher ratio of adults to children ($p < .01$).

Discussion

These findings demonstrate the explanatory power of a transactional model which includes biologic and family ecology risk factors in predictions of cognitive development and representational ability at 18 months of age in young children initially hospitalized for failure to thrive during their first year of life. For these measures, neither nutritional physical status or family variables yielded as strong a prediction as these variables in combination. Although the specific manner in which family structure and resources and nutritional status affect social interactions between children and their caretakers is not known, Pollitt (1969, 1973) has described an interactional model of malnutrition emphasizing the mutual contribution of child and family environment which may also be relevant to the understanding of failure to thrive outcome. It is likely that failure to thrive children who are not severely malnourished when first hospitalized are more stimulating, socially responsive partners in interactions with adult caretakers than malnourished children who are often withdrawn and less able to engage adult caretakers in interactions. The child's ability to claim the time and attention of adult caregivers may be an important compensatory factor, especially in an impoverished environment. On the other hand, diminished social responsiveness may be especially problematic for children in families who are already limited by low economic resources and few adult caretakers.

Predictions based on a transactional model of biologic vulnerability and family ecology were not equally effective at each age or with every measure. A transactional model may be most applicable to developmental functions such as cognitive development and representational play that may require the physical presence and availability of adult caretakers for optimal development. The significant predictions based on wasting suggests that the child's initial nutritional state may have a longer term influence on adaptive behavior. The fact that predictions of outcome were much stronger for wasting than for stunting reflect differences in what these measures assess (Waterlow, 1973) and the potential relationship to family environment. In contrast to stunting, wasting is more reflective of acute nutritional status which in turn may be more related to behavior and hence to longer-term psychological competence. In future research, it will be useful to assess predictions of attachment and social-emotional development which are often disrupted in failure to thrive (Gordon & Jameson, 1979).

Generalizability of Findings

Cross-validation of these findings is warranted in view of the special characteristics of the present sample and the heterogeneous nature of failure to thrive. Based on a highly disadvantaged urban sample, the present findings may not be as applicable to failure to thrive associated with more advantaged families. Chatoor and Egan (1983) have identified a subgroup of failure to thrive characterized by a dysunctional relationship

between mother and child rather than depletion of family economic resources. Environmental variables predictive of psychological outcome in this subgroup would be more likely to reflect the quality and structure of parent-child relationship rather than family resources.

The present sample also included children who were identified early in life (on the average of five months of age) and recruited by chart reviews of hospitalized children and vigorous effects to encourage pediatric identification. Failure to thrive children recruited at this age and in this manner may have lesser degrees of impairment then samples comprised of children with more chronic histories of poor weight gain or those referred by pediatricians (Fitch et al., 1975; Singer & Fagan, in press). Future studies are needed to determine the generalizability of these findings to studies of recovery among children who demonstrate severe impairments at point of identification as well as to untreated children.

Future studies might concentrate on the nature of the allocation. Some disadvantaged families are much more efficient than others in setting priorities on food, time, and parental attention in the context of limited resources (Belle, 1981; Bolton, 1983) and conflicts between parental needs and those of their children (Trivers, 1978). It is also possible that assessment of social support (Cobb, 1974), family stress, density (Waldrop & Bell, 1964) or social interaction (Burgess & Conger, 1978) would yield predictions equal to our better than the measures of family

ecology used in the present study. Intriguing questions remain concerning the interrelationship between family social support and resource allocation. For example, it is quite possible that a high level of family support allows more efficient utilization of personal and economic resources and hence better psychological outcomes.

Clinical Implications

The present findings suggest that it is reasonable to extend the focus of clinical assessment in failure to thrive to a broad range of variables including the child's physical status, family resources and structure. The variables used as predictors in the present study have the advantage of objectivity and can be obtained by professionals in a variety of settings. For example, physical status as assessed by wasting and stunting can be readily obtained by applying conversions to the growth data usually obtained for each failure to thrive child. It is also possible to assess family size, income, and the number of adults to children via interview and observation.

The present findings have implications for clinical intervertion in failure to thrive. To the extent that initial physical and nutritional status is relevant to psychological outcome, it may be important to initiate a vigorous and prolonged approach to the treatment of nutritional deficiencies associated with failure to thrive, as recommended by some pediatric researchers (Kerr, Ashworth, Poultor, Seakins, Spady & Wheeler, 1973). Clinical interventions

with the families of failure to thrive infants should also address relevant aspects of family ecology. For example, families with significant resource problems may benefit greatly from advocacy to enable them to procure economic or nutritional resources that are potentially available but administered by bureaucratic agencies which can present formidable barriers (Nagi, 1980; Piven & Howard, 1971). The use of enabling or empowering strategies (Biegel, 1983; Nagel, 1972) to help families actively negotiate on their own behalf not only can yield direct benefits for the family but enhance parental sense of efficacy (Bandura, 1977). In addition to directly addressing resource depletions, helping families to change the way resources are allocated to failure to thrive children may be a very useful intervention. Families who operate in a context of severe resource scarcity can be helped to set priorities for resource allocation which give primary claim to the more vulnerable failure to thrive child, at least for a time (Drotar & Malone, 1982; Minuchin, 1974). Future research and clinical intervention in failure to thrive might be profitably based on ecological models which specify the interrelationships among family ecology, parent-child interaction and outcome (Garbarino, 1977) and the parental coping strategies necessitated by the unique stresses (e.g., finances, dealing with bureaucracies, crime) associated with economic disadvantage (Gecas, 1979; Stack, 1974).

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Requests for reprints may be addressed to Dennis Drotar, Ph.D., Rainbow Babies & Childrens Hospital, 2101 Adelbert Road, Cleveland, Ohio 44106.

TABLE 1

Physical Growth and Psychological Measures

	INTAKE (N=68)		12 MONTHS (N=67)		18 MONTHS (N=65)	
	M	SD	M	SD	M	SD
Height (cm)	59.7 (20th %ile)	6.5	72.5 (25th %ile)	2.9	79.1 (26th %ile)	3.0
Weight (kg)	4.6 (5th %ile)	1.3	8.6 (21st %ile)	1.1	10.1 (27th %ile)	1.2
Head Circumference (cm)	39.9 (25th %ile)	3.2	45.7 (29th %ile)	1.5	47.2 (38th %ile)	1.3
Bayley MDI	99.3	16.3	109.6	15.1	102.4	13.6
Behavioral Ratings	11.2	2.6	13.8		12.1	3.0
Language	-	-	-	-	17.8	3.3
Symbolic Play	-	-	-	-	7.7	2.6

Table 2

Multiple Correlations Predicting Psychological Outcome

Prediction of 12 Month Outcome

Bayley MDI

Variable	R	Beta	F to enter
Ratio adult-child	.26	.255	4.47*
F (1,64) = 4.47*			

Behavioral Rating Score

Variable	R	Beta	F to enter
Wasting	.30	-.296	6.93*
F(1,64) = 6.93*			

Prediction of 18 Month Outcome

Bayley MDI

Variable	R	Beta	F to enter
Income	.40	.404	11.53**
Wasting	.48	-.272	5.37**
F(2,57) = 8.67**			

Behavioral Rating Score

Wasting	.25	-.253	4.04*
F(1,60) = 4.04*			

Symbolic Play Score

Income	.38	.378	9.86**
Ratio adult-child	.47	.296	7.02**
Wasting	.54	-.283	6.17**
F = (3,57) = 8.07**			

Language Ability

Ratio adults-child	.38	.352	10.13**
F (1,60) = 10.13**			

*p $\leq$ .05
**p $\leq$ .01